*BY ORDER OF THE COMMANDER*
*30TH SPACE WING*

*30TH SPACE WING INSTRUCTION 48-102*

*30 OCTOBER 1998*

*Aerospace Medicine*

# *CONTROL OF RADIOFREQUENCY RADIATION*

**COMPLIANCE WITH THIS PUBLICATION IS MANDATORY**

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This instruction provides guidance procedures, safety measures, and responsibilities for controlling radiofrequency (RF) radiation on Vandenberg Air Force Base (AFB). It provides guidance on developing and purchasing of hazardous RF equipment or systems, medical examination and surveillance program. This instruction applies to all assigned, attached, and tenant units as well as contractors who use, site, construct, modify or operate RF sources on Vandenberg AFB. **Attachment 1** explains glossary and terms used. The Paperwork Reduction Act of 1974 as amended in 1996 and AFI 37-160, Volume 8, *The Air Force Publications and Forms Management - Developing and Processing* Forms, affects this publication.

## *SUMMARY OF REVISIONS*

The revision of this publication is to meet the format standards required by the Air Force. No content material has changed. Some required format changes have been made to allow for the conversion process. Paragraphs have also been renumbered to fit the new format.

## 1. Responsibilities:

1.1. The Commander, 30th Medical Group:

1.1.1. Establishes policy and requirements for controlling RF radiation through the 30th Aerospace Medicine Squadron (30 AMDS/SGPB), Bioenvironmental Engineering Flight (BEF).

1.1.2. Oversees medical examination requirements for personnel who may have been overexposed to RF radiation. Medical services for contractor personnel are per Air Force directives and support agreements.

1.2. Unit Commanders Responsible for RF Radiation Emitters:

1.2.1. Provides notification to Bioenvironmental Engineering Flight (BEF), 30TH Space Wing Safety (30 SW/SE), and respective tenant safety offices of intended use of new or modified RF systems.

1.2.2. Appoints a Unit Radiation Safety Officer (URSO) to BEF in writing annually.

1.2.3. Ensures operating, maintenance, and emergency procedures are reviewed annually by the respective safety offices and maintained at each RF site.

1.2.4. Ensures access to hazardous or suspected hazardous RF areas are controlled and identified to prevent unauthorized entrance per Air Force Occupational and Safety (AFOSH) Standard (STD) 48-9, *Radio Frequency Radiation (RFR) Safety Program.*

1.2.5. Ensures annual training is provided to all personnel working around RF devices.

1.2.6. Ensures personnel exposure remains below the standards outlined in Institute for Electrical and Electronic Engineers (IEEE) publication C95.1-1991, *Standard for Safety Levels* with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz. Incidents involving potential overexposures of personnel are reported and investigated as required by AFOSH STD 48-9 and AFI 91-204, *Safety Investigating and Reports*.

1.3. Bioenvironmental Engineering Flight (BEF) (30 AMDS/SGPB):

1.3.1. Compiles and maintains a comprehensive inventory of all RF emitters on Vandenberg AFB.

1.3.2. Reviews and approves or disapproves all RF radiation producing equipment and systems based on actual or potential personnel or environmental hazards.

1.3.3. Evaluates and categorizes theoretical hazard distances on all hazardous RF emitters.

1.3.4. Performs or reviews hazard distance calculations and field surveys prior to or during initial use. Risk based visits will be performed to review operating parameters and safety issues thereafter.

1.3.5. Evaluates RF systems for toxic or inert gases associated with the system, noise hazards from power generation equipment, warning signs and labels, and ionizing radiation from high voltage tubes in the systems.

1.3.6. Evaluates suspected or reported overexposure of personnel to radiofrequency electromagnetic radiation.

1.3.7. Assists URSOs on training issues if requested.

1.4. Public Health (PH) (30 AMDS/SGPM):

1.4.1. Provides briefings or other health education consultations concerning RF radiation when requested by URSOs or Commanders.

1.4.2. Initiates action to investigate alleged or suspected RF radiation overexposures. Where required, prepares and distributes AF Form 190, **Occupational Illness/Injury Report**, and additional documentation as required for these cases, as specified in AFI 48-101, *Aerospace Medical Operations*, and AFOSH STD 48-9.

1.4.3. Ensures any medical follow-up examinations for persons identified as having been overexposed are performed.

1.4.4. Ensures that a copy of each investigation report is placed in the involved individual's medical records.

1.5. 30 Space Wing Safety (30 SW/SE):

1.5.1. Provides explosive safety services and consultation for all uses of RF producing equipment and systems.

1.5.2. Reviews and approves (or disapproves) all proposed RF equipment and systems on Vandenberg AFB for radiation hazards to electro-explosive devices and volatile fuels.

1.5.3. Reviews all proposed RF equipment and system sitings to ensure established explosive clear zones and primary explosives transportation routes are not affected or violated.

1.5.4. Analyze associated operations for flight or ground operations to ensure radars do not violate specified limits for personnel, ordnance and critical equipment.

1.5.5. Review and approve hazardous operation procedures.

1.6. Base Contracting Offices: Ensure contractors implement AFOSH STD 48-9, IEEE C95.1-1991 and this instruction’s requirements through appropriate contractual agreements and procurement actions.

1.7. 30th Range Scheduling (30 RANS/DOUS):

1.7.1. Authorizes frequencies used on Vandenberg AFB.

1.7.2. Notifies BEF of requests to site or change frequencies at Vandenberg AFB so hazard evaluations can be reviewed and conducted, if necessary.

1.8. Unit Radiation Safety Officers (URSO):

1.8.1. Prepares unit operating instructions (OI) to identify and control personnel access to areas containing hazardous RF radiation levels, and specify procedures to be followed in the event of an accidental overexposure.

1.8.2. Acts as single point of contact for the unit on all RF radiation safety matters, and maintains an active liaison with BEF and PH personnel.

1.8.3. Notifies BEF prior to any change in location of a RF emitter so a hazard evaluation can be reviewed and conducted, if necessary. Notification must be in writing.

1.8.4. Notifies BEF of any modification or significant operational procedure change made to an existing RF system. The notification must be provided to BEF in writing 30 days prior to the expected change.

1.8.5. Conducts RF radiation training for all personnel working in RF radiation areas. Training should include the hazards of RF radiation, control measures and emergency procedures in the event of an accidental exposure. Training must be documented on AF Form 55**, Employee Safety and Health Record**, for Department of Defense (DoD) personnel and personnel records for contractors.

1.8.6. Notifies BEF immediately of all suspected incidents or accidents, unusual occurrences or overexposures to RF.

1.8.7. Obtains BEF and 30 SW/SE approval for all RF emitter operating procedures before initial operation.

1.8.8. Provides a detailed written description of proposed special projects to BEF and 30 SW/SE. Proposals must include all potential hazards and conditions associated with the project and applicable safety measures.

1.8.9. Maintains an inventory and accountability of all RF emitters and systems under their control. Sends inventory updates to BEF as soon as possible after the change has been made.

1.8.10. Ensures all radiation hazard areas are identified, posted per AFOSH STD 48-9, and have a controlled entry. Flashing lights near areas with easy access to potentially hazardous levels of RF radiation may be required. **NOTE:** A hazard area exists whenever radiation levels exceed the maximum permissible exposure levels established in IEEE C95.1-1991 for controlled and uncontrolled environments.

1.8.11. Ensures operating maintenance and emergency procedures for each RF emitter or system are current and maintained at the RF radiation work area.

1.8.12. Inspects transmission lines/waveguides periodically for cracks or other defects which might allow leakage.

1.8.13. Ensures the base master comprehensive planning document is updated with the location of all RF systems and equipment. **NOTE:** If the proposed RF emitter site is in an established explosive clear zone or explosive site, a plan must be submitted and approved before the system is installed.

1.9. All Users of RF Equipment and Systems:

1.9.1. Notifies URSO of any modification or change to RF equipment systems.

1.9.2. Ensures all radiation hazard areas are identified, posted per AFOSH STD 48-9, and have a controlled entry.

1.9.3. Ensures unattended RF systems are secure at all times.

1.9.4. Ensures the URSO or Safety Officer, BEF, Commander, 30 AMDS, and 30 SW/SE are notified immediately of all suspected incidents or accidents, unusual occurrences or overexposures.

1.9.5. Ensures a buddy system or two-man policy is used during maintenance of RF equipment or systems identified as hazardous or potentially hazardous.

1.9.6. Completes all training requirements.

1.9.7. Ensures operating maintenance and emergency procedures for the system is maintained at the site.

1.9.8. Complies with all posted operating maintenance and emergency procedures.

1.9.9. Inspects transmission lines periodically for cracks or other defects which might allow leakage.

**2. RF Approval Procedures.** All organizations developing or buying potentially hazardous RF equipment or systems must obtain written authorization from BEF and 30 SW/SE, if applicable. The user will

forward, by memorandum, the following information so that a theoretical hazard evaluation may be conducted and an equipment inventory maintained:

2.1. Name, location and telephone number of responsible organization

2.2. Nomenclature of emitter (name, number, manufacturer and model number).

2.3. Frequency or frequencies of operation (MHz).

2.4. Mode of operation (pulsed or continuous wave).

2.5. If pulsed:

2.5.1. Pulse width (seconds)

2.5.2. Pulse repetition frequency (Hz)

2.6. Peak and average power output (watts)

2.7. Gain and sweep characteristics of antenna

2.8. Beam width (azimuth and elevation)

2.9. Voltage ratings for consideration of possible x-ray hazard. **NOTE:** Submit this data no later than 30 days prior to initial startup of the equipment. The theoretical hazard evaluation will be used as a guide for an initial survey of the installation if necessary. This review must be accomplished before the RF system is approved for normal operation.

**3. Access Control.** The using organization will control access to RF hazard areas on Vandenberg AFB. Violations of these areas during emitter operation may be considered an "incident" and treated as a potential overexposure.

**4. Radiofrequency Safety Devices.**

4.1. General Control Guidelines:

4.1.1. Incorporate engineering control mechanisms as part of the transmitter system (such as shielding, interlocks, antenna stops, etc.).

4.1.2. Deny unauthorized or transient personnel access to any exclusion area associated with a RF transmitter. Use signs, warning lights, physical barriers, interlocks or area surveillance to designate the hazardous areas wherever applicable.

4.1.3. In areas where easy access to "very high levels of RF" radiation may exist, install a flashing light near the antenna site to indicate RF transmission.

4.1.4. Post operating and emergency procedures at each transmitter site.

4.1.5. Keep maintenance procedures for the specified system at the site.

4.1.6. Interlock cabinets containing high voltage components to prevent access while high voltage is on.

4.1.7. Area visitors must be escorted and briefed to ensure they comply with established safety precautions.

4.1.8. Ranging on non-target vehicles or aircraft is prohibited, except as authorized by the Vandenberg Base RSO.

4.1.9. Never leave an operating RF system unattended or unsecured.

4.2. Special Control Provisions. Specific control provisions may be assigned as a result of the calculation and survey authorization process. These controls reflect the degree of hazard represented by the particular system.

4.3. Associated System Hazards. A list of hazards to be considered when working with RF devices includes but is not limited to:

4.3.1. Electrical hazards associated with high voltage components and associated wiring.

4.3.2. X-ray radiation produced by high voltage components.

4.3.3. Ozone concentrations produced by high voltage components.

4.3.4. Radioactive materials contained in certain types of high voltage tubes.

4.3.5. Infrared radiation hazards associated with communications, beacons, navigation, direction finding, tracking and missile guidance systems, etc.

4.3.6. Toxic substances.

4.3.7. Inert gases under pressure

4.3.8. Petroleum oils and lubricants

4.3.9. Electro-explosive devices

4.3.10. Mechanical hazards to head, feet and arms

**5. Medical Surveillance Program:**

5.1. Medical Examinations. Routine, pre- or post-employment medical examinations are not required for personal occupationally exposed to RF radiation. This differs from the preplacement and termination ophthalmic examinations procedures recommended in Chapter 3, DoD Manual 6055.5, *Occupational Health Surveillance Manual*, and requires the following statement be included on AF Form 2766, **Clinical Occupational Health Examination Requirements**, for facility case files which involve potential exposure to RF radiation. **NOTE:** "The medical examination recommendations in Chapter 3 of DoD 6055.5M are not appropriate for Air Force use because there is no known scientific or epidemiological basis to support the requirement. Bioeffects research and epidemiological studies have shown that ocular effects are a threshold phenomenon occurring only at levels more than 10 to 100 times the proposed permissible exposure levels; are indistinguishable from those caused by aging and other physiological events; and have not been demonstrated conclusively in humans exposed at levels below the current Occupational Safety and Health Act (OSHA) Occupational Exposure Limit (OEL). The Air Force medical surveillance program in effect since 1975, which requires eye examinations and continued follow-up of personnel who have received documented overexposure, shows no significant incidence of ocular effects from Radio Frequency Radiation (RFR) Safety Program for levels as high as 100 mw/cm2."

5.2. In the event of suspected overexposure to an individual, that person's medical history will be reviewed by a physician. The individual will be given an examination per AFI 48-123, *Medical Examination and Standards*. Depending on the results and symptoms, consultations by specialists

may be obtained in accordance with AFOSH STD 48-9. All incident follow-up and documentation will also be performed in accordance with AFOSH STD 48-9.

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**Attachment 1**

**GLOSSARY OF REFERENCES, ABBREVIATIONS, ACRONYMS, AND TERMS**

***References***

AFI 48-101, *Aerospace Medical Operations*

AFI 48-123, *Medical Examination and Standards*

AFI 91-204, *Investigating and Reporting U. S. Air Force Mishaps*

AFOSH STD 48-9, *Radio Frequency Radiation (RFR) Safety Program*

T.O. 31Z-10-4, *Electromagnetic Radiation Hazards*

DoD 6055.5M, *Occupational Health Surveillance Manual*

IEEE C95.1-1991, *IEEE Standard for Safety Levels with Respect to Human Exposure to Radio Frequency Electromagnetic Fields, 3 kHz to 300 GHz*

***Abbreviations or Acronyms***

**AFB—**Air Force Base

**BEF—**Bioenvironmental Engineering Flight

**DoD—**Department of the Defense

**IEEE—**Institute for Electrical and Electronic Engineers

**GHz—**Gigahertz

**Hz—**Hertz

**MHz—**Megahertz

**OEL—**Occupational Exposure Level

**OI—**Operating Instruction

**OSHA—**Occupational Safety and Health Act

**PH—**Public Health

**RF—**Radiofrequency

**RSO—**Radiation Safety Officer

**URSO—**Unit Radiation Safety Officer

***Terms***

**RF Emitter—**Any device which is designed to generate RF energy and couple this energy into the surrounding space.

**NonHazardous RF Emitters—**RF equipment which radiates at frequencies below 1000 Mhz and delivers less than 7 watts of power to the radiating device.

**Visitor—**Any person who is not occupationally exposed to RF radiation.

**Controlled Environment—**Locations where there is exposure that may be incurred by persons who are aware of the potential for exposure (occupationally exposed worker).

**Uncontrolled Environment—**Locations where there is the exposure to individuals who have no knowledge or control of their exposure (non-occupationally exposed worker).

**Hazardous—**RF radiation which exceeds the standards specified in ANSI C95.1-1991 for controlled and uncontrolled environments.